

Impact of Disasters on Community Medical Screening Examination and Vaccination Rates: The Case of the Sewol Ferry Disaster in Ansan, Korea

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ABSTRACT

Objective: In April 2014, the Sewol ferry sank off the coast of Korea, resulting in 304 deaths. Of these, 250 were local high school students from Ansan, and the disaster severely affected their community. This study investigated the association of this disaster with health examination, cancer screening rate, and vaccination rate.

Methods: The study subjects were adults ages ≥ 19 years (11 026 Ansan residents and 1 361 624 non-residents of Ansan) who participated in the 2011–2016 Korea Community Health Survey. The national health screening program examination rate, cancer screening rate, and influenza vaccination rate in Ansan residents and non-residents were assessed and their responses compared using chi-square tests, multiple logistic regression analyses, and a stratification analysis according to depression.

Results: After the disaster (2014–2016), non-residents received more health screening (adjusted odds ratio [aOR] = 1.13, $P < 0.001$), cancer screening (aOR = 1.41, $P < 0.001$), and vaccination (aOR = 1.10, $P = 0.002$) than Ansan residents. This difference was more evident in the group without a depressive mood.

Conclusion: People living in disaster areas show lower rates of medical screening examination and receive fewer vaccinations after the disaster. To decrease health impacts by disaster, efforts to increase community health screenings and vaccinations may be needed.

Key Words: cancer screening, community, health screening, impact of disasters, vaccination

In April 2014, the Sewol ferry disaster was a tragic event in Korea. The Sewol ferry sunk in the southern area of the West Sea in Korea with 476 passengers on board, including 325 students and 14 teachers from Danwon High School. Only 172 passengers survived, and 304 passengers died in the disaster. In total, 250 students and 11 teachers from Danwon High School died in this accident, and the sinking of the Sewol ferry harshly traumatized the Korean society.¹ The mental health impacts of Ansan citizens and Danwon High School students were greater because many of the dead were students from Danwon High School located in Ansan (Figure 1).

Disaster exposure affects the mental health of the victims and the community, often causing serious mental problems, such as posttraumatic stress disorder (PTSD) and acute stress disorder.^{2,3} After a disaster, directly-affected victims and communities may also experience psychological problems, such as depression, anxiety, and suicide.^{4,5} Even those community members who were not affected directly by the disaster experienced trauma-induced symptoms, including sleep disturbances or concentration problems.⁶ These

mental health problems can lead to notable social disruption and affect the health problems of the community.

In addition to mental health problems, physical health can be affected following a disaster.⁷ After experiencing a disaster, the prevalence of chronic diseases, including cardiovascular disease, increases.⁸ Additionally, people with chronic diseases receive worse management of the disease because there are changes in diets and physical activities that could affect physical health status and chronic disease management.⁹ Disasters also tend to impact the entire population's physical and mental health, such as depression.¹⁰ Particularly, health care in a population can be neglected. However, to our knowledge, there has been no report about the impact of disaster on the health care of affected communities, specifically regarding medical screening examination and vaccination rates.

To address this research gap, our study examines the difference between health screening rates and vaccination rates between disaster-affected and unaffected cities. Our primary research aim was to examine the

FIGURE 1

Maps of the Affected Community (Ansan) and Danwon High School.



association of disaster exposure with national health screening program examination, cancer screening rate, and vaccination rate. Additionally, we explored the effect of depressive symptoms after a disaster on health and cancer screening rates and vaccination rates.

METHODS

Data

Data from the 2011–2016 Korea Community Health Survey (KCHS) were used for this study.¹¹ The KCHS was conducted by the Korea Centers for Disease Control and Prevention and was performed by extracting an average of 900 population groups representing communities. Participants were adults ages 19 years and above, who were selected through a probability proportional to size systematic sampling. This survey was performed using a 1:1 direct interview conducted through computer-assisted personal interviewing. Among the study participants were 5524 persons who lived in Ansan city and participated in the survey in 2011–2013 (before the disaster), and 5502 participants who lived in Ansan and participated in the 2014–2016 survey (after the disaster). As a control group, all respondents living outside of Ansan city were included: 681 404 persons in 2011–2013 and 680 220 persons in 2014–2016.

Measurements

In this study, the questionnaire items related to the health screening examination (national health screening programs), cancer screening examination, influenza vaccination, age, sex, educational status, marital status, employment status, depressive mood, stress level, and health status were used in the analysis. The National Health Insurance Service in Korea conducts national health screening programs annually, consisting of the general health screening program and the transitional age health screening program.¹² The stress level of daily life was measured through the following questions: “How much stress do you usually feel in your daily life?”¹³ (Available answers were “very stressful,” “somewhat stressful,” “not very stressful,” and “not stressful at all”). Individuals with a depressed mood were defined as providing a “yes” answer to the question: “Have you ever felt sad or hopeless enough, which interfered with your daily life in the past year?”¹⁴ Self-reported health status was measured by a single-item self-reported indicator: “In general, how would you rate your health?”¹⁵ Responses to questions were “poor,” “fair,” “average,” “good,” and “excellent.” Receiving health screening and cancer screening examinations was defined as answers of “yes” to the question: “Have you ever had a health screening (or cancer screening) examination to check your health, even if you have no health problems in the last two years?”

TABLE 1

Differences in Health Screening, Cancer Screening, and Vaccination Rates Between Ansan Residents and Non-Residents (Classified Before and After the Sewol Ferry Disaster)

		2014-2016		OR	Adjusted OR ^a	P-value
		Received (%)	Not Received (%)			
Health Screening Examination	Residents outside of Ansan	70.2%	29.8%	1.37 (1.30-1.45)	1.13 (1.07-1.20)	< 0.001
	Resident in Ansan	63.3%	36.7%	1 (Ref)	1 (Ref)	
Cancer Screening Examination	Residents outside of Ansan	58.5%	41.5%	1.70 (1.61-1.79)	1.41 (1.33-1.49)	< 0.001
	Resident in Ansan	45.3%	54.7%	1 (Ref)	1 (Ref)	
Influenza Vaccination	Residents outside of Ansan	46.8%	53.2%	1.59 (1.51-1.68)	1.10 (1.04-1.17)	0.002
	Resident in Ansan	35.6%	64.4%	1 (Ref)	1 (Ref)	
		2011-2013		OR	Adjusted OR ^a	P-value
		Received (%)	Not Received (%)			
Health Screening Examination	Residents outside of Ansan	66.6%	33.4%	1.27 (1.15-1.39)	1.06 (0.96-1.17)	0.257
	Resident in Ansan	61.2%	38.8%	1 (Ref)	1 (Ref)	
Cancer Screening Examination	Residents outside of Ansan	53.6%	46.4%	1.18 (1.08-1.29)	0.96 (0.87-1.06)	0.425
	Resident in Ansan	49.5%	50.5%	1 (Ref)	1 (Ref)	
Influenza Vaccination	Residents outside of Ansan	44.1%	55.9%	1.55 (1.46-1.64)	1.09 (1.02-1.15)	0.009
	Resident in Ansan	33.8%	66.2%	1 (Ref)	1 (Ref)	

^a Adjusted for age, sex, educational status, marital status, employment status, depressive mood, stress level, and health status.

OR = odds ratio.

Receiving influenza vaccination was defined as an answer of “yes” to the question: “Have you been vaccinated for influenza in the last year?” The validity of the health screening questionnaire was confirmed.¹⁶

Statistical Analysis

In this study, the proportions of those who received and did not receive health checkups, cancer screenings, and vaccines were examined during the 2011–2013 and 2014–2016 periods before and after the Sewol ferry disaster occurred. The Sewol accident occurred in April 2014, and the 2014 Community Health Survey was conducted in October. Therefore, responses in 2014 were considered as post-disaster. We compared the rates of health checkups (national health screening programs), cancer screening examination, and vaccinations between respondents living in Ansan and non-residents. We performed a logistic regression analysis to investigate the difference. In logistic regression analysis, univariate and multivariate logistic analyses were performed. To determine the effect of post-accident depression on vaccination and screening rates, we divided the respondents in 2014–2016 by depression. We confirmed the difference in the health and cancer screening and vaccination rates between residents and non-residents in Ansan through ratio analysis and logistic regression analysis. We used Stata version 14.2 (StataCorp, College Station, TX) for all statistical analyses. A 2-sided $P < 0.05$ was considered statistically significant.¹⁷

RESULTS

Depressive Mood, Stress, and Health Status of Participants in 2011–2013 and 2014–2016

In comparing before (2011–2013) and after (2014–2016) the Sewol accident, the depression of Ansan residents rose from

9.3% to 10.1%, whereas the depression rate of non-residents in Ansan increased from 5.4% to 6.6% (Table 1). In the case of stress level, the percentages of highly stressed Ansan residents rose from 4.7% to 5.1% and from 3.3% to 3.7% for non-residents in Ansan. In the case of self-reported health status, the respondents who reported that they had an excellent health status decreased from 5.8% to 5.1% for Ansan residents, and decreased from 6.1% to 5.7% for non-residents in Ansan. Group differences in the change of depressive mood, stress, and health status were not significant.

Differences in Health Screening, Cancer Screening, and Vaccination Rates Between Ansan Residents and Non-Residents

In the 2011–2013 period, there was no difference in the rate of medical screening examination between residents and non-residents in Ansan when adjusted for sociodemographic factors, depression, stress level, and health status (adjusted odds ratio [aOR] = 1.06; 95% CI = 0.96 to 1.17; $P = 0.257$; see Table 1). There was no significant difference in cancer screening (aOR = 0.96; 95% CI = 0.87 to 1.06; $P = 0.425$). However, in the case of influenza vaccination, residents in Ansan city showed a significantly lower vaccination rate even before the Sewol ferry accident (aOR = 1.09; 95% CI = 1.02 to 1.15; $P = 0.009$). In 2014–2016, those who did not live in Ansan city received more health screening (aOR = 1.13; 95% CI = 1.07 to 1.20; $P < 0.001$), more cancer screening (aOR = 1.41; 95% CI = 1.33 to 1.49; $P < 0.001$), and more vaccination than residents in Ansan (aOR = 1.10; 95% CI = 1.04 to 1.17; $P = 0.002$). Vaccination rates showed a significant difference in both periods, but, in 2014–2016, there was a greater difference in proportions (ratio difference = 11.2% in 2014–2016, and 10.3% in 2011–2013).

TABLE 2

Differences in Health Screening, Cancer Screening, and Vaccination Rates in 2014–2016 Between Ansan Residents and Non-Residents (Classified as Having Depressed Mood or Not)

		<i>Not Having Depressed Mood</i>		OR	Adjusted OR^a	P-value
		Received (%)	Not Received (%)			
Health Screening Examination	Residents outside of Ansan	70.60%	29.40%	1.38 (1.30-1.46)	1.26 (1.08-1.48)	0.035
	Resident in Ansan	63.50%	36.50%	1 (Ref)	1 (Ref)	
Cancer Screening Examination	Residents outside of Ansan	58.70%	41.30%	1.73 (1.63-1.83)	1.41 (1.33-1.50)	< 0.001
	Resident in Ansan	45.10%	54.90%	1 (Ref)	1 (Ref)	
Influenza Vaccination	Residents outside of Ansan	46.60%	53.40%	1.64 (1.55-1.74)	1.12 (1.05-1.20)	< 0.001
	Resident in Ansan	34.60%	65.40%	1 (Ref)	1 (Ref)	
		<i>Having Depressed Mood</i>		OR	Adjusted OR^a	P-value
		Received (%)	Not Received (%)			
Health Screening Examination	Residents outside of Ansan	65.30%	34.70%	1.13 (1.06-1.20)	1.05 (0.88-1.25)	0.611
	Resident in Ansan	61.80%	38.20%	1 (Ref)	1 (Ref)	
Cancer Screening Examination	Residents outside of Ansan	55.70%	44.30%	1.40 (1.19-1.66)	1.30 (1.09-1.56)	0.003
	Resident in Ansan	47.30%	52.70%	1 (Ref)	1 (Ref)	
Influenza Vaccination	Residents outside of Ansan	50.00%	50.00%	1.27 (1.08-1.51)	0.90 (0.75-1.09)	0.281
	Resident in Ansan	44.00%	56.00%	1 (Ref)	1 (Ref)	

^a Adjusted for age, sex, educational status, marital status, employment status, stress level, and health status.

OR = odds ratio.

Differences in Health Screening, Cancer Screening, and Vaccination Rates in 2014–2016 Between Ansan Residents and Non-Residents According to Having a Depressed Mood

When comparing Ansan residents and non-residents after the Sewol ferry incident, there was no difference in the medical screening examination (aOR = 1.05; 95% CI = 0.88 to 1.25; $P = 0.611$) and vaccination rates in the depressed mood group (aOR = 0.90; 95% CI = 0.75 to 1.09; $P = 0.281$; Table 2). However, in the depressed mood group, cancer screening rates were significantly higher among those not living in Ansan (aOR = 1.30; 95% CI = 1.09 to 1.56; $P = 0.003$). In the group without depressed mood, non-residents in Ansan received more health screening (aOR = 1.26; 95% CI = 1.08 to 1.48; $P = 0.035$), cancer screening (aOR = 1.41; 95% CI = 1.33 to 1.50; $P < 0.001$), and vaccination (aOR = 1.12; 95% CI = 1.05 to 1.20; $P < 0.001$) than residents in Ansan. In the case of cancer screening rate, the difference in screening rate was significantly greater in the group without depression (difference in proportion = 13.6% in the group without depressed mood, and 8.4% in the group with depressed mood).

DISCUSSION

This study showed that the Sewol ferry disaster affected the community medical screening examination, including cancer screening and influenza vaccination rates. People living in the same area as disaster victims tended to receive fewer health checkups and vaccinations after the disaster, even if they did not directly experience the disaster. This difference was more evident in the group without a depressive mood, indicating that

attention should be paid to health care even in groups that did not have mental health problems after the disaster.

Health concern for a society after a disaster is mainly focused on psychiatric aspects.¹⁸ Especially in the case of disasters that result in many deaths, such as the Sewol disaster, many psychiatric problems, such as PTSD, can occur.¹⁹ However, in addition to psychiatric problems after a disaster, various health problems arise in the community. These health changes may be related to changes in socioeconomic status after a disaster²⁰ or may be due to neglect of health care after a disaster. A previous study showed that residents in disaster areas were more likely to drink alcohol, which may affect their mental or physical health.²¹ Moreover, disasters affect health behaviors, such as tobacco use and drug use.²² In other words, the occurrence of a disaster could affect not only physical and mental health, but also health behavior.

However, the impact of disasters on preventive health care utilization, such as health screenings, is not yet known. Considering the long-term impacts of disasters on health,^{23,24} identifying the impact of disasters on preventive health care utilization may be necessary to investigate the influences of disasters on community health. This study confirmed that disasters adversely affect the health concerns of residents. Neglect of health screenings and vaccinations in disaster areas could lead to long-term health burdens in the community. Specifically, disasters could increase the burden on physical health, as well as on mental health care in disaster areas. In view of the results of previous work that an increase in the incidence of diseases requires chronic management among disaster residents,²⁵ it is

thought that this reduction in preventive health care utilization could have a marked impact on community health.

In order to consider the possibility of PTSD or post-disaster depression affecting health screening and vaccination, the participants were divided into 2 groups, namely, those who reported a depressive mood and those who did not. As a result, there was no significant difference in the screening rate and vaccination rate in the depressed mood group, but a significant difference was found in the non-depressed mood group. Accordingly, it could be confirmed that depression after the disaster did not affect health care. This finding means that even non-depressed populations are likely to have long-term health effects after a disaster. Based on our findings, we should also pay attention to screening and vaccination when managing population health in disaster areas.

Limitations

This study has several limitations. First, because of the cross-sectional nature of the data, we were unable to examine causal relationships between disaster and health screening or vaccination. Second, this study is based on self-response and may be underestimated. Finally, the results of the study may not be directly applied to other countries. Nevertheless, the study provides insights into the relationship between disasters, medical screening, and vaccination. Prospective studies may explore situations in other kinds of disasters and the causal relationship between disasters, medical screening examination, and vaccination.

CONCLUSIONS

People living in disaster areas tended to show lower rates of medical screening examination and receive fewer vaccinations after the disaster. Especially, the difference between screening rates and the vaccination rates was noticeable in the group that did not report a depressive mood. Decreased health screening and vaccination after a disaster could be associated with increased long-term health burdens. To reduce health impacts after a disaster, increased community health screenings and vaccinations may be needed.

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Conflict of Interest Statement

The author has no conflict of interest to declare.

Supplementary material

To view supplementary material for this article, please visit <https://doi.org/10.1017/dmp.2020.29>

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